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A Conceptual Framework for Technology Education: A Historical Perspective

The idea for *A Conceptual Framework for Technology Education* (Savage & Sterry, 1990) came about as a result of a walk between conference venues at the Tulsa International Technology Education Association (ITEA) conference in 1988. Len Sterry and I were discussing the changes that were occurring in the professions of technology and the inability of the professions to react to those changes. We both felt that the front end material of the Jackson's Mill document was timeless but that the content organizers and processes were beginning to become dated. Also, we felt that the field was beginning to ask, "What comes after Jackson's Mill?" Certainly the work that Tom Wright spearheaded with the Chicago 10 Curriculum Implementation Project operationalized Jackson's Mill, but it could go no further than the work that it was attempting to "hang" a curriculum upon. At the Mississippi Valley Industrial Teacher Education conference that following November, we approached Gene Martin for his perspective regarding the possibility of having the Technical Foundation of America (TFA) fund such an effort. Due to his encouragement to us to submit a proposal, the TFA funded our effort and allowed us to begin the process at the ITEA conference the following spring of selecting 25 leaders in the field to participate. Tom Erekson, Tom Wright, and Kendall Starkweather served as trustees for the project and assisted greatly in the selection process. Walter Waetjen served as facilitator for each session, and Len Sterry and I served as codirectors. Among the participants, there were representatives from 15 states, 18 colleges or universities, 2 state departments of education, 1 high school, and 1 national organization. The commitment of the participants was to meet for three 3-day periods to create a product that would provide a framework for the study of technology in the 1990s.

A Conceptual Framework for Technology Education endorsed the human adaptive systems and domains of knowledge of the *Jackson's Mill Industrial Arts Curriculum Theory* (Snyder & Hales, 1981) while also focusing on the human as a problem solver who, through the application of the technological method model, could identify and address problems and opportunities and solve problems using resources and technological processes while considering the outcomes and consequences of such activity. The significant contributions of this document are the listing of the universal attributes of technology; the comparison of the features of the body of knowledge of technology to the features of science and the humanities/arts (see Figure 1); the development of the technological method model (see Figure 2) and its "spin-off"—a model for technology education (see Figure 3); the inclusion of a broader base of content for the study of technology: the recognition of educational philosophies and bodies of knowledge related to technology, science, and the arts/humanities (see Figure 4); identification of the methodological and content characteristics of a quality technology education program; and a process model for a course of study. As with any document of this kind, it was recognized that this work represented a new departure or "paradigm shift" for our profession.

	TECHNOLOGY	SCIENCE	HUMANITIES/ARTS
DEFINITION	STUDY OF THE HUMAN MADE WORLD	STUDY OF THE NATURAL WORLD	STUDY OF VALUE STUDY OF HUMAN BEHAVIORS
METHOD OF INQUIRY	TECHNOLOGICAL METHOD	SCIENTIFIC METHOD	ECLETIC METHOD SCIENTIFIC PHENOMENOLOGICAL METHODS
CONTENT EXAMPLES	BIO RELATED COMMUNICATION PRODUCTION TRANSPORTATION ETC.	BIOLOGY CHEMISTRY PHYSICS MATH ETC.	HISTORY PHILOSOPHY LANGUAGE SOCIOLOGY ANTHROPOLOGY PSYCHOLOGY ETC.

Figure 1. Features of bodies of knowledge.

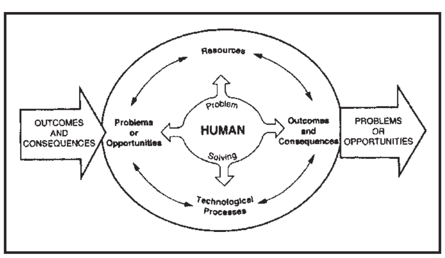

Figure 2. The technological method model.

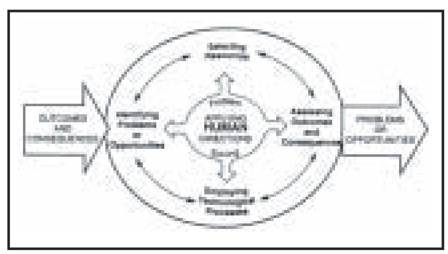

Figure 3. A model for technology education.

	SCIENCE	TECHNOLOGY	HUMANITIES/ARTS	
INDIVIDUAL NEEDS	NUTRITION	RESEARCH AND DEVELOPMENT	CIVIC RESPONSIBILITY (VOTING)	CREATIVE WRITING PAINTING
SOCIAL PROBLEMS	ENVIRONMENTAL STUDIES	ENERGY EFFICIENCY	GLOBAL STUDIES	VALUES CLARIFICATION CENSORSHIP
ACADEMIC RATIONALISM	CHEMISTRY	PROCESSING	HISTORY	ENGLISH LITERATURE MUSIC THEORY
TECHNICAL PROFICIENCY	MATHEMATICS	MANUFAC-TURING	DEMOGRAPHICS	JOURNALISM PHOTOGRAPHY
INTELLECTUAL PROCESSES	HYPOTHESIS GENERATION	INVENTION	TECHNOLOGY ASSESSMENT	ART APPRECIATION EPISTEMOLOGY

Figure 4. Examples of educational philosophy and bodies of knowledge.

Context and Significance

A Conceptual Framework for Technology Education represents pieces and parts of many curricular ideas, educational philosophies, and ideologies that preceded it. Figure 5 is an attempt to contextualize those parts. Any effort of this kind, and with the experts who were involved, will spring from a diverse and multigirded philosophical base. Of prominence is the philosophy of social reconstructionism which recognizes that the human, armed with the knowledge of resources and processes, can interact with necessary constituents to solve problems. The work of Bonser almost 90 years ago (Andrews & Erickson, 1976) provided the framework for industrial arts focusing on technologies of the home. This was in contrast to Selvidge's (1909) work that resulted in the Standards of Attainment for the Industrial Arts as part of vocational education. Bonser's perspective was modernized by Snedden and Warner (1927) and then refocused to reflect the technologies of dominant industries by Warner et al. (1952). Warner et al. also supported Wilbur's (1948) definition of industrial arts, which was paraphrased in Maley's (1973) definition leading to the Maryland Plan. The Industrial Arts Curriculum Project (IACP; Towers, Lux, & Ray, 1966) also has some Warner influence as does the American Industry Project (Face & Flug, 1967). Both those projects influenced the Jackson's Mill effort which in turn influenced the Conceptual Framework effort. Some might say that this interpretation of our curricular efforts has provided evidence of the incestuous nature of our field. I find it difficult to deny that perspective. With the exception of IACP and the Standards for Technological Literacy Project (ITEA, 2000), there have never been substantive funds to "go outside" of our field for different views of industry or technology. We are still in our infancy as a discipline and, as such, are still trying to determine what we want to be when we grow up.

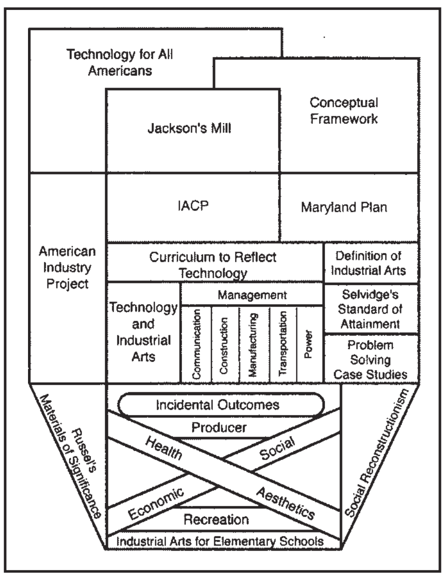

Figure 5. Foundation for the conceptual framework.

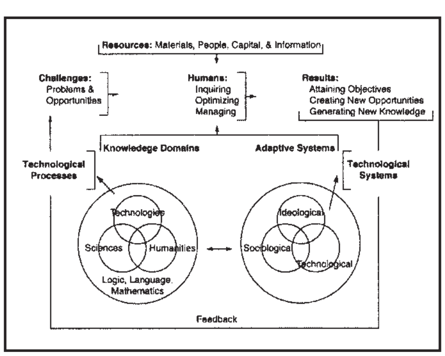

Figure 6. Technological method (Sterry) model.

Content That Reflects Technology

The coauthor of *A Conceptual Framework for Technology Education*, Len Sterry, has reflected on the place that our document has in its linkage with contemporary initiatives. With his permission, I am presenting his perspective in the next several paragraphs. Note that Len calls his model "the technological method," a potential for confusion on the part of the reader, but Len was clear about his commitment to the new model as his view of the evolving representation of technology. Therefore, the term will be used with (Sterry) tagged to the model for clarification purposes.

The ITEA (2002) and its Technology for All Americans Project developed and published *Standards for Technological Literacy: Content for the Study of Technology*, with funding from the National Science Foundation and the National Aeronautics and Space Administration. Technology content standards are designed to help ensure that all students receive an effective education about technology by setting forth a consistent content for the study of technology. More specifically, the standards include the nature of technology, technology and society, design, abilities for a designed world, and the designed world. All five standard categories and all 20 standards are of equal importance.

The Technological Method (Sterry)

The technological method (Sterry) is a model by which we "do" technology. By definition, technology is "know-how that extends human capability." It is more than just knowing; it is knowing and being able to do! It is based on a human desire to produce an outcome. So how does it work?

As individuals, organizations, countries, and a world community, we are constantly faced with challenges, problems, and opportunities. To address these challenges, we draw upon our individual and collective knowledge bases along with other resources to produce a desired result. When we are short of ability, we try to learn more through research and study. As we meet a challenge we usually create new problems and opportunities. In the process we also generate new knowledge that is added to our collective knowledge pool. And thus, the cycle continues, exponentially.

Technological Processes

The body of technological knowledge, according to our frameworks and standards, includes our ability to manipulate matter and information. According to Negroponte (1995) in his book *Being Digital* and other curricular models, the world can be classified as consisting of atoms and bits. Atoms account for the physical world of living and nonliving matter while bits make up the world of information. Information and materials technology represent, therefore, the know-how we apply to manipulating our world. These processing concepts apply to all situations as we provide goods and services ranging from health care to automobiles, from entertainment to structures, from travel to education, and from family life to our global community. They are fundamental processes that apply universally. Therefore, they are concepts that, if taught and understood by students, will be transferable to many situations. Conceptual understandings will also provide students with an ability to deal with technological change in the future, both personally and professionally. While information and materials technology could appear in the school program as technological systems of the designed world, these technologies are significant to the extent that they will also be a major part of the total curriculum design.

Technological processes are a result of the knowledge domain in the technological method. The processes usually include processing information and processing matter/materials, both living and nonliving. Depending on a person's perspective, instrumentation is sometimes included as a part of processing information and energy is often separated from the bigger concept of processing matter. In a practical sense, either way will get the job done. Design is sometimes considered as a universal technical concept and included as a technological process. Again, this is not correct in a pure sense but does work well as a practical application.

Technological Systems

As stated earlier, *Standards for Technological Literacy: Content for the Study of Technology* (ITEA, 2000) identified seven systems for the designed world. The U.S. Department of Education identifies 16 clusters associated with occupational education. Others have their own set of favorites.

The technological method (Sterry) model identifies a category of human adaptive technological systems that could include any number of systems, depending on how one might choose to organize this part of the model. However, according to Sterry and Hendricks' (1999) *Exploring Technology*, there are generic concepts that apply to human adaptive technological systems:

- Designing/determining products and services—Making decisions about what product or service will be produced.
- Planning production—Determining how the product or service will be delivered.
- Obtaining resources—Securing materials, energy, personnel, financing, and information.
- Tooling for production—Procuring or constructing the necessary apparatus and equipment.
- Actuating the process—Making it happen.
- Controlling production—Monitoring and adjusting the process.
- Packaging—Containerizing the product or service for protection, appeal, and transport.
- Distributing—Marketing and moving the product or service to storage or the consumer.
- Maintaining—Servicing products and relationships.

Using these concepts as a framework, different technologies or systems can be outlined. Some examples include communication; transportation; manufacturing; construction; information; materials; food and fiber; air, land, water, and environmental; energy; medical; and entertainment and media.

Summary

Each of our efforts, if they continue to build on the works of our best thinkers and doers, will contribute to the puzzle that will become our recognized field of study. The recommendations from the conceptual framework document sheds some light on our future. Among other things, they speak to the need to be multidisciplinary in our approach to technological literacy and our charge to provide essential knowledge at all levels of society, including the workforce. Technology will never go away. We should assume that our field will ultimately become recognized as an essential component of education for all learners.

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